

Magyar et al. delivered a very complete investigation on thermal equilibrium reactions of N<sub>2</sub>O isotopologues, including clear explanations on the methods used, which will therefore be of great use for future efforts on establishing calibration schemes for clumped and SP N<sub>2</sub>O isotopes. An improved method for thermal equilibration of N<sub>2</sub>O is presented, as well as a new calibration scheme of clumped and SP N<sub>2</sub>O isotope composition measurements. I appreciate the high number of experiments that were done, the authors clearly made a great effort and succeeded in giving very complete overview on the characteristics of thermal equilibration of N<sub>2</sub>O isotopes.

Before publication the quality of the figures needs to be improved, both in resolution and in presentation. Sometimes text and figures seem to be not consistent with each other, please see the general questions and comments. Also, applicability of the research would benefit if the authors relate the results in the research better to the precision and accuracy requirements of the applications in environmental research. This will pave the way for future work on this subject and enhance applicability of the research done. Furthermore, there are minor improvements that can be made in the text to increase readability, see the general questions and comments indicated per line. After implementing the comments, I would definitely advise to publish this paper in AMT as the research clearly adds to new insights on doing precise measurements of clumped and SP N<sub>2</sub>O isotope composition, as well as bringing the isotope community's aim of having compatible results amongst different laboratories closer using absolute reference frames.

General questions and comments:

Line 152: From the text so far, it is not clear why the duration has to be between 6 and 162 hours, please add some context to clarify.

Line 174: There is stated that this precision is adequate to resolve differences among natural materials, but no reference or indication is given about the required precision for measurement of natural materials. Please add this information to the introduction.

Line 179: As the experiments covered in this research are as long as a week, please add information on stability of the instrument over longer time periods than 15 minutes.

Line 181: Figure S2 shows that the first expansion is clearly less stable than the subsequent expansions. Is there an explanation for this? Is this also observed when doing sample measurements, and should the first expansion be excluded from the data analysis to improve precision?

Figure 4: From the zoom frame of the upper figure, it is expected that the outlier is also included in the zoom, which it is not. Please correct this.

Line 220: Here there is stated that 3 starting materials were used while only two starting materials are shown in figure 4?

Line 253: Please make clear in the text that results from experiments that were previously done at 200 degree C are also included in the results in figure 6.

Figure 6: Can you add the information on the amount of N<sub>2</sub>O in the figure to make sure readers do not miss this information?

Line 287: Is this the temporal isotopic evolution, not clear from the text or from figure 7.

Table 1: please use consistent terminology in your table, caption and text. Now it is confusing to read “theoretical prediction” in the text and caption but “Equilibrium” as the header of the column.

Please add “Measured” before “SP values are reported using the value assigned by comparison with Science Tokyo ...” in the caption of table 1.

Spelling:

Line 27 add right punctuation: “The clumped isotopologues of N<sub>2</sub>O: <sup>14</sup>N<sup>15</sup>N<sup>18</sup>O, <sup>15</sup>N<sup>14</sup>N<sup>18</sup>O, and <sup>15</sup>N<sup>15</sup>N<sup>16</sup>O, show...”

Line 34: add space between “of” and “≥8”

Line 61: Add dot at end of sentence

Line 92: “to be delivered to the intermediate gas volume..”

Line 14:1 add dot at end of sentence